

3. On a new Pennatulid from the Japanese Sea. By Dr. A. A. W. HUBRECHT, C.M.Z.S., Professor of Zoology at the University of Utrecht.

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(Plates XXX. & XXXI.)

In the year 1874, Captain St. John, then in the Japanese sea, at $34^{\circ} 11' N.$, $136^{\circ} 33' E.$, captured at a depth of 71 fathoms two specimens of Pennatulids (see Plate XXX. figs. 1-3). They passed into the possession of Professor W. C. MacIntosh of St. Andrews, whose numerous duties and arduous researches in another field of Zoology (Report on the Annelids of the 'Challenger,' &c.) allowed him no leisure to make anything more than a superficial examination of the animals in question. When, in 1884, I had the pleasure of making a short stay at St. Andrews for the purpose of utilizing the numerous facilities offered by the Zoological Station which at the initiative of this distinguished biologist, has arisen at that interesting point of the Scottish coast he kindly showed me over his extremely rich collection of marine invertebrates, mostly in spirit and in excellent state of preservation. We came upon the bottle containing the Japanese specimens, and as I noticed certain distant points of resemblance with Solenogastres, in which I was at the moment particularly interested (presence of calcareous spicules in the integument, club-shaped form, faint longitudinal groove on the concave side, &c.), Prof. MacIntosh most courteously put both the specimens at my disposal for a more detailed anatomical examination.

I was very glad to accept the proposal. This paper contains the result of my investigations, for which, as far as the internal structure is concerned, only one of the specimens (fig. 1) was sacrificed, the other one (figs. 2 & 3) having been returned to the owner intact. Moreover the series of sections which were made through the first specimen were all duly preserved, and are now at St. Andrews.

An examination of the two specimens with low power very soon dispelled the possibility of any relationship to the Solenogastres, and showed the organism to be a colony, from which the shrivelled bodies of the polyps with their fringe of long tentacles might be seen to emerge. It was in the thickened portion, the rhachis (*r*), that this was noticed; the stem (*s*) is devoid of polyps and terminates in a rounded knob, which shows a faint swelling just before the lower extremity. Subterminally there was on the concave side a very short oblong furrow, at the bottom of which no opening whatever could be detected.

The colour of both specimens is of the light brownish-red which is reproduced in the figures; and superficial examination revealed the existence not only in the stem, but along the whole rhachis, of delicate calcareous spicules, so densely accumulated as to make the

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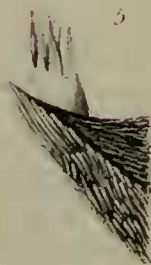
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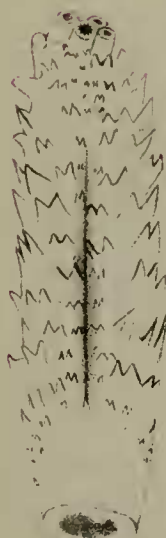
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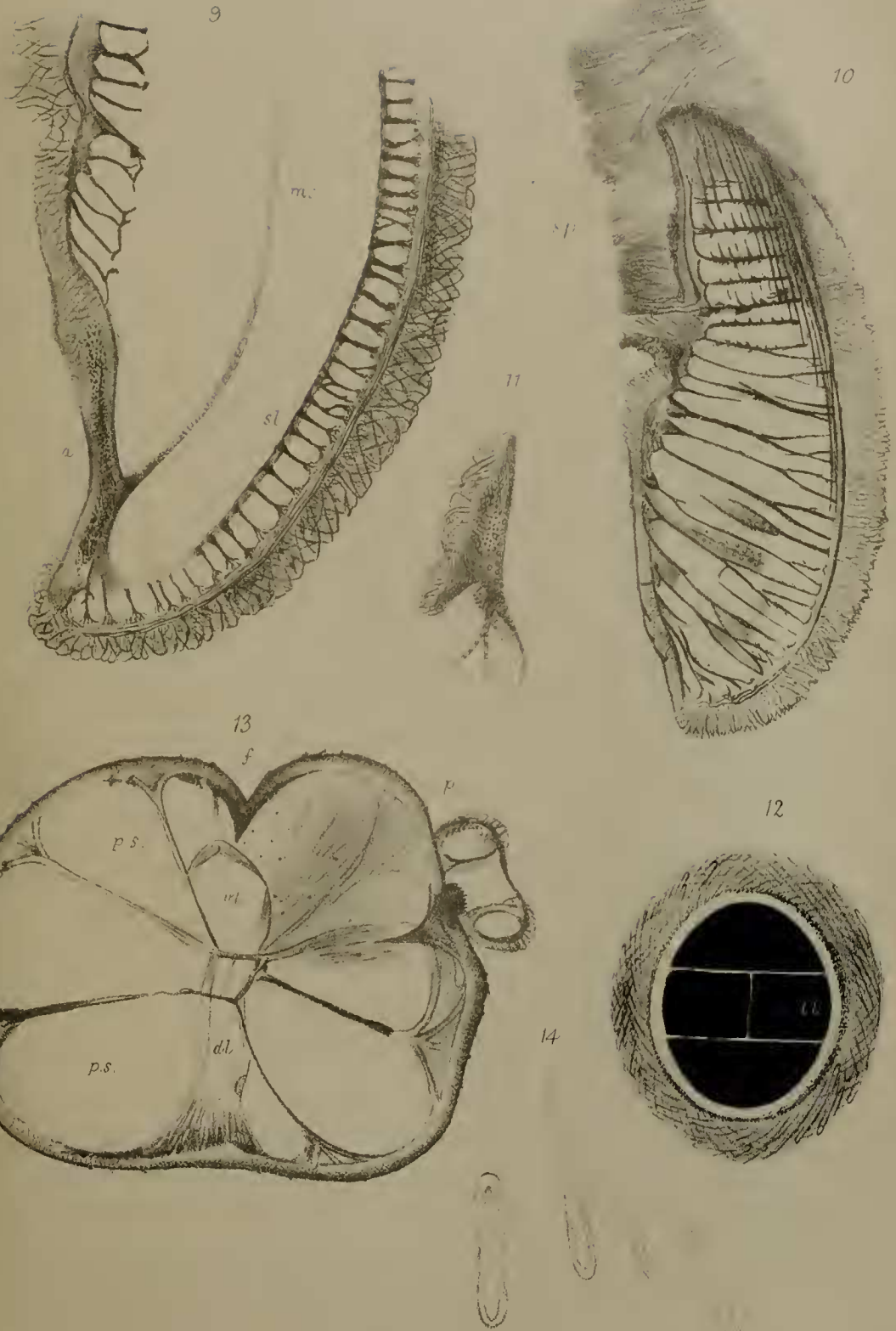
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whole colony feel hard and rigid when handled. Whereas in the stem these calcareous needles—for such they proved to be on microscopic examination (see fig. 14)—are in no way raised above the common level (faint transverse wrinkles being, however, observable), their aspect on the rhachis is considerably different. Here they unite to form projecting polyp-cells, which have the aspect of shields or scales (figs. 4 & 5), but which merge into the proper surface of the rhachis. These apparent scales are moreover provided with two projecting points, well marked in the different figures, and also wholly consisting of the same needle-like spicules; whereas they are arranged along the rhachis in what appeared to be faint spirals, ascending from the concave (ventral) side towards the convex (dorsal) one, and directed forwards, *i. e.* towards the extremity of the scaleless stem. Figs. 6 and 7 show that there are no continuous spirals, but that along the median line of the convex surface the rows of large scales are interrupted by a longitudinal band of very minute scales, answering, however, to the same type, but apparently without any projecting polyps, and which, after Kölliker, may well be called zooids (*vide infra*). At the top of the stem the polyp-cells have not yet acquired the definite and characteristic shape which is indicated in fig. 5. The few which may here be noticed have a more circular, nipple-like aspect; those just below the top are intermediate between the lateral and the top ones.

The characters above enumerated are sufficient to raise a strong suspicion that the colony in question is a Pennatulid. Longitudinal and transverse sections of stem and rhachis will enable us to test this supposition by means of the internal anatomy.

The general impression from a transverse section through the rhachis is this, that the colony is much less massive and solid than the external appearance and the rigidity would lead us to suppose. We notice a spongy arrangement of large-sized spaces, separated by a system of thin septa and trabeculae (figs. 13 & 8), the arrangement of which we shall hereafter have occasion to examine in detail. When touched with the forceps the material that builds up this internal framework is found to be stiff and brittle, and microscopic examination shows that this part of the *cœnenchyma* is also laden with very numerous calcareous spines (fig. 14), similar in shape to those found in the exterior investment. These spines, though of uniform shape, are of different size. The organic ground-substance in which they are imbedded is moreover stiff and horny, and is dissolved in caustic potash. Together with the calcareous spicules, it gives to the internal framework its rigidity.

In a section through the stem (fig. 12 and woodcut, p. 515, figs. 1 & 2) the arrangement of these septa is seen to be more regular, the free spaces are very symmetrically arranged, and the outer wall is in comparison thicker than in the rhachis.

Towards the inferior extremity of the stem there is only one transverse septum, dividing its inner space into a dorsal and a ventral half. This septum is seen in a longitudinal section (perpendicular to its plane) in fig. 9. It appears gradually to split into two parallel

septa as we proceed towards the rhachis, a transverse connecting septum, however, keeping up a direct continuity, and being placed perpendicularly to the two parallel ones, and at the same time symmetrically. The internal space is consequently now divided into four spaces instead of two, two lateral spaces having made their appearance in addition to the dorsal and ventral (Plate XXXI. fig. 12, and woodcut, p. 515, fig. 2). When we examine the figures in Kölliker's monograph ('Anatomisch-systematische Beschreibung der Alcyonarien, I. Pennatuliden,' plate x. fig. 78 ; plate xiv. figs. 107-113 ; plate xxi. fig. 180 ; plate xxiii. fig. 212) of sections through the stems of different genera of Pennatulids, we find that there, too, a similar arrangement of the septa and the spaces obtains, and that towards the inferior extremity of the stem the spaces are also reduced to two. One remarkable difference to be noticed in our specimen is this, that whereas in the other Pennatulids an axis of more or less considerable size and massive consistency appears and is situated in the median vertical septum above alluded to (*cf.* Kölliker's figs. 78, 108, 110, 212), *such an axis is entirely absent in Echinoptilum*, no trace of it being found either in the stem, the lower part of the rhachis, or its upper portion. The septum in which it is always developed is there, however, as was just noticed.

We must now observe that in the rhachis the dorsal, ventral, and lateral spaces which we have been describing for the stem, and which are here so symmetrically placed, are none the less present throughout the whole of the rhachis, but are here reduced in size by the development of spaces exteriorly to them, in which the polyps will partly be lodged. Fig. 13 gives a satisfactory representation of this arrangement. It is a section in the lower third of the rhachis, and shows us the two parallel septa with the perpendicular one between them, situated in the axis of the rhachis, and at the same time the four spaces which they help to enclose, uninterruptedly continued from the stem into the rhachis, their bulk being, however, not inconsiderably reduced.

At the top of the rhachis they disappear, transverse sections showing that they only reach so far as close to the top, but that at the very extremity only the additional spaces *ps* belonging to the terminal polyps are present ; this would to a certain extent bring out another point of comparison between the septa here discussed and those carrying the axis in other Pennatulids, the latter structure being known not to attain the topmost extremity of the polyparium, but to stop short close to the top of the rhachis. The accompanying woodcut (p. 515) exemplifies diagrammatically the arrangement of the primitive spaces in transverse sections of different regions of the polyparium. For comparison fig. 4 is copied from Kölliker.

Returning now to the base of the stem, we note in longitudinal sections (fig. 9) that here the short median, ventral, and subterminal furrow, already mentioned above when reviewing the external characters of the specimen, is indeed a depression in the integument, and that at the bottom of this depression a flat expansion of the sclerenchyma separates the cavities of the hollow stem from the